

THE BERNARD M. BARUCH COLLEGE

OF

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HERBERT ARKIN
Professor Emeritus

May 15, 1980

Mr. H. Thomas Austern
Covington & Burling
888 Sixteenth Street NW
Washington, DC

Dear Mr. Austern:

As requested, I have examined the data records consisting of laboratory determination calculation sheets and statistical summary sheets which you represented to me to be copies of the original laboratory data sheets compiled by the Federal Trade Commission and used as the basis for figures on "tar" TPM (Dry) and nicotine yields of various brands of cigarettes as well as the final reports on these data released by the Federal Trade Commission.

It was the laboratory data sheets for the "tar" and nicotine figures released by the Federal Trade Commission under the date December 1979 which I examined and upon which I report in this letter.

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The number of brands tested in the current report rose to 176 as compared with 167 in the prior report.

The data handling care in the FTC laboratory in this set of data (Test No. 22)¹ remained at about the same level as for the prior test (Test No. 21).

The number of calculational errors increased to 8. There were 2 impossible figures. Further, there were 5 instances of incorrect posting to the summary sheets and 8 instances not posted to the summary sheets from the laboratory sheets.

The number of deletions of determinations rose to a new high at 20.4% of the determinations deleted. The number of deletions excluding "deleted days" rose from 458 for Test No. 21 to 494 for the current test (No. 22).

¹. The prior tests performed by the FTC laboratory were dated November 20, 1967-No. 1; June 11, 1968-No. 2; October 10, 1968-No. 3; February 27, 1969-No. 4; July 9, 1969-No. 5; November 19, 1969-No. 6; May 18, 1970-No. 7; October 21, 1970-No. 8; August 1971-No. 9; March 1972-No. 10; August 1972-No. 11; February 22, 1973-No. 12; September 18, 1973-No. 13; March 1974-No. 14; September 1974-No. 15; March 1975-No. 16; September 1975-No. 17; April 1976-No. 18; November 1976-No. 19; August 1977-No. 20; May 1978-No. 21.

There continues to be evidence of variations resulting in wide swings in the daily levels of the reported data in spite of large scale deletions of all determinations for entire days. The phenomena are similar to those reported in my prior letters.

A. CALCULATION AND POSTING ERRORS

The level of calculational errors was about the same as for the prior test (Test No. 21). There were 8 such errors found in the current Test No. 22.

The history of calculational errors on the FTC laboratory sheets is shown in the table below:

<u>Date of Report</u>	Number of Calculational Errors* "Tar" and Nicotine Determinations Federal Trade Commission Laboratory Sheets		
	Brand	Monitor	<u>Total</u>
	<u>Cigarettes</u>	<u>Cigarettes</u>	
October 10, 1968	65	**	
February 27, 1969	73	**	
July 9, 1969	42	**	
November 19, 1969	43	20	63
May 18, 1970	60	15	75
October 21, 1970	5	0	5
August 1971	4	18	22
March 1972	2	1	3
August 1972	4	4	8
February 22, 1973	12	3	15
September 1973	23	1	24
March 1974	2	1	3
September 1974	4	2	6
March 1975	6	4	10
September 1975	1	1	2
April 1976	0	0	0
November 1976	8	1	9
August 1977	6	5	11
May 1978	6	1	7
December 1979	7	1	8

*Calculational differences were counted only if the error was at least 0.2 mgms for TPM (Dry) and 0.02 for nicotine. The individual errors are listed in Appendix I.

**Not counted for these reports.

There were 5 instances in which data for monitor cigarettes were posted incorrectly to summary sheets. In addition, there were 8 brand determinations not posted to the summary sheets. These errors are noted in Appendix II.

In addition, there were 2 impossible figures as shown in Appendix III. In two determinations the value for TPM (Dry) was reported as a negative figure which were posted as zero values to the summary sheets.

The advent of such impossible figures would indicate an error in the determination method probably due to a nonlinearity in the true values.

B. DISCARDS

In my prior analyses it was noted that a considerable amount of data on the laboratory sheets were discarded by merely stamping the column for a determination "deleted". It was observed that the result of such a practice is to falsely give an impression of much greater uniformity of test results than actually exists in fact.

It was pointed out that the FTC follows the practice of discarding "unusual" nicotine and "tar" TPM (Dry) determinations and not including these values in the reported averages based on an outlier test as well as to discard entire day's determinations when the monitor averages for those days do not meet a certain test.

There was an increase in the total deletions as compared with the previous test to a new record high. The number of discards in the various tests are shown below:

Nicotine and TPM Determinations
Discarded in Tests 5 Through 22

<u>Test Number</u>	<u>Monitor Cigarettes</u>	<u>Brand Cigarettes</u>	<u>Total</u>
5	77	62	139
6	19	72	91
7	94	272	366
8	17	76	93
9	158	232	390
10	436	235	671
11	333	193	526
12	263	231	494
13	165	216	381(a)
14	283	163	446
15	202	533	735
16	106	294	400(b)
17	296	815	1111(c)
18	117	359	476(d)
19	156	581	737(e)
20	221	746	967(f)
21	163	587	750(g)
22	212	982	1194(h)

(a) Includes 14 deletions on summary sheets not on lab sheets.

- (b) Includes 186 deletions where it was indicated that all data for that day was deleted (stamped deleted day) and 2 instances where deletions were made on the summary sheets but not the lab sheets.
- (c) Includes 896 deletions where it was indicated that all data for that day was deleted and 2 instances where deletions were made on summary sheets but not lab sheets.
- (d) Includes 297 deletions where it was indicated that all data for that day was deleted and 2 instances where deletions were made on summary sheets but not on lab sheets.
- (e) Includes 439 deletions where it was indicated that all data for that day were deleted.
- (f) Includes 787 deletions where it was indicated that all data for that day were deleted.
- (g) Includes 292 deletions where it was indicated that all data for that day were deleted and 7 instances where deletions were made on the summary sheets but not on lab sheets.
- (h) Includes 700 deletions where it was indicated that all data for that day were deleted and 5 deletions were made on the summary sheets but not indicated on the lab sheets.

The 1194 deletions represented 20.4% of all determinations.

Thus, 1 in every 5 determinations noted on the laboratory sheets were deleted.

It should be noted that the number of deletions arising from "deleted days" rose sharply from 292 for Test No. 21 to 700 for Test No. 22, the current test, while the total number of deletions of individual port results rose from 458 for the previous Test No. 21 to 494 for the current test No. 22. These deletions are the result of the application of the Dixon outrider test by the FTC laboratory.

In the FTC letter to Mr. Kornegay dated May 5, 1978, it is noted that "of approximately 5000 samples tested in 1974, there remained only 252 which were deleted..... giving a rate of 5.4% as predicted by the Dixon outrider test."

In the current test No. 22, the percent of determinations discarded as a result of the outlier test was much higher. There were 494 such deletions out of a total of 5140 determinations after removing the 700 for deleted days resulting in 9.6% of the determinationd discarded because of the outlier test. This high rate beyond that predicted for the test gives rise to a question about the suitability of the outlier test for this purpose.

As emphasized in my prior reports, in spite of the best efforts of cigarette manufacturers, cigarettes must vary considerably because of the inherent variability of the agricultural product used (tobacco) and the nature of the manufacturing process. Thus, individual wide variations may be expected from cigarette to cigarette. Since the consumer uses the cigarette as received, there seems to be little justification for discarding values, unless supported by specific evidence of laboratory mistakes.

Since the above differences in cigarettes will result in exclusion from the test results of unusual cigarettes, the use of the outlier test to exclude individual port results is highly questionable. It is suggested that outliers might more appropriately be excluded only on the basis of evidence of experimental error or impossible results (negative water, tar, nicotine, etc.).

C. VARIATIONS IN TEST LEVELS

In accordance with sound scientific methods, the FTC laboratory included control (monitor) cigarettes in their smoking runs for the determinations of nicotine and "tar"

delivery levels of the brands of cigarettes tested. These cigarettes are samples of a homogeneous larger group of cigarettes prepared for this purpose. All smoking machine runs are said to have included several ports which are dedicated to the smoking of these monitor cigarettes, the results of which are processed in the same manner as the brands being tested.

The purpose of such control (or monitor) cigarettes is to detect shifts or unusual variations arising out of changes in laboratory conditions, such as variations in the smoking machines, laboratory conditions, etc..

As reported previously, there is continuing evidence of shifts in the results for individual days as evidenced by the value obtained for the monitor cigarettes for certain days as compared with others.

Federal Trade Commission
Data Dated December 1979
TPM (Dry) Determinations

<u>Date</u>	<u>Average For Day</u>	<u>Overall** Average</u>	<u>Number Days Below Average</u>	<u>Number Days Above Average</u>
August 7, 1979	19.2	18.4	21	50
October 10, 1979	17.7	18.4	38	14

*For those brands for which tests were conducted on the specified days. There were 4 brands with results equal to the average for August 7, 1979 and 5 for October 10, 1979.

**Excluding value for specified day.

NOTE: The results for the brands for the specified days are given in Appendices IV and V.

The table above illustrates one of these gyrations in the daily figures for TPM (Dry). The monitor runs for October 10, 1979 were below average. Similarly, a high percent of brand cigarettes tested on October 10, 1979 were below average with few above average. The probability that this disparity for brand cigarettes is merely an accident of sampling is less than .0001 and thus the difference is significant. In similar fashion, the monitor average for August 7, 1979 were above average and a high

percentage of the brand tests for that day were above average. The probability of this difference being an accident of sampling is less than .001.

It is to be noted that due to a change in the company producing the monitor cigarettes, the TPM results rose for the last 3 tests (Tests No. 20, 21 and 22) from an average of the prior five tests (Tests No. 15 thru 19) of 18.1 to 18.6, while the nicotine averages rose from 1.28 to 1.35.

E. ROUNDING ERRORS

In my analysis dated December 3, 1973, I first discussed the rounding error problem. The problem has arisen again.

The apparent rounding method intended was that if the TPM average in the tenths of a mgm position was exactly 5 or more the value would be rounded up, if less, rounded down (truncated). For instance, an average TPM of precisely 14.5000 would be rounded to 15 but 14.4999 would be truncated to 14. Similarly in the second decimal of the nicotine average, a reported figure of 1.25000 would be raised to 1.3 but 1.24999 would be truncated to 1.2. This is sound procedure.

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Mr. H.T. Austern

There were three errors in rounding according to this rule, which were found in the Report of "Tar" and Nicotine Content of the Smoke of 176 Varieties of Cigarettes, December 1979, published by the FTC in the increasing order of nicotine values and increasing order of tar values listings of brands data as shown below:

Federal Trade Commission
"Tar" and Nicotine Determinations
Data Dated December 1979

Rounding Errors

<u>Brands</u>	Average TPM (Dry) <u>FTC</u> <u>Report</u>	<u>Summary</u> <u>Sheet</u>
Newport Lights k,f,sp,m,85mm	10	9.495
Pall Mall k,f,sp,85mm	19	18.27

<u>Brand</u>	Nicotine <u>FTC</u> <u>Report</u>	<u>Summary</u> <u>Sheet</u>
Salem f,sp,m,100mm	1.5	1.4075

Sincerely,

Herbert Arkin

HA:koc

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Appendix I
Federal Trade Commission
"Tar" and Nicotine Determinations
Data Dated December 1979

Calculation Errors on Laboratory Sheets

<u>Date</u>	<u>Cigarette</u>	<u>Run</u>	<u>Port</u>	<u>TPM (Dry)</u>		<u>Nicotine</u>		<u>See</u>
	<u>No.</u>			<u>Original</u>	<u>Corrected</u>	<u>Original</u>	<u>Corrected</u>	<u>Notes*</u>
BRAND CIGARETTES								
8/9/79	85	2	15			1.02	1.09	1
8/14/79	63	1	3	16.8	17.0			2
8/29/79	78	3	14	7.9	8.6			3
9/5/79	73	5	9			1.25	1.27	4
9/27/79	92	5	1			.70	.77	5
8/21/79	74	4	4	6.5	6.7			6
7/18/79	27	2	5	27.6	27.3			7
MONITOR CIGARETTES								
8/24/79	16M	5	19	1.54	1.29	16.9	17.1	8

* NOTES:

- Nicotine Calculation:
$$\frac{[1.059 (.499 - \frac{1}{2} (.207 + .083))] \times 500}{34.3 (5)} = 1.09 \text{ not } 1.02.$$
- TPM(Wet) Calculation:
$$\frac{[(33.5379 - 33.4335) \times 1000]}{5} = 20.9 \text{ not } 20.7.$$

Therefore, TPM(Dry) = 20.9 - 2.67 - 1.21 = 17.0, not 16.8.
- Water calculation:
$$\frac{[(686 \div 2941) + (-.0661)] / .0392 (5)}{34.3 (5)} = .85 \text{ not } 1.53.$$

Therefore, TPM (Dry) = 10.1 - .85 - .64 = 8.6 not 7.9.
- Nicotine Calculation:
$$\frac{[1.059 (.588 - \frac{1}{2} (.251 + .102))] \times 500}{34.3 (5)} = 1.27 \text{ not } 1.25.$$
- Nicotine Calculation:
$$\frac{[1.059 (.695 - \frac{1}{2} (.278 + .114))] \times 250}{34.3 (5)} = .77 \text{ not } .70.$$
- Water Calculation:
$$\frac{[(505 \div 2876) + (-.0282)] / .0442 (5)}{34.3 (5)} = .67 \text{ not } .92.$$

Therefore, TPM (Dry) = 8.0 - .67 - .59 = 6.7 not 6.5.
- TPM (Wet) Calculation:
$$\frac{[(33.0530 - 32.8878) \times 1000]}{5} = 33.0 \text{ not } 33.3.$$

Therefore, TPM (Dry) = 33.0 - 4.08 - 1.67 = 27.3 not 27.6.
- Nicotine Calculation:
$$\frac{[1.059 (.566 - \frac{1}{2} (.213 + .086))] \times 500}{34.3 (5)} = 1.29 \text{ not } 1.54.$$

Therefore, TPM(Dry) = 22.9 - 4.49 - 1.29 = 17.1 not 16.9.

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Appendix II
Federal Trade Commission
"Tar" and Nicotine Determinations
Data Dated December 1979
Posting Errors to Summary Sheets

<u>Date</u>	<u>Run</u>	<u>Port</u>	<u>TPM (Dry)</u>		<u>Nicotine</u>	
			<u>Posted As</u>	<u>Should Be</u>	<u>Posted As</u>	<u>Should Be</u>
<u>Monitors</u>						
7/26/79	5	14	18.4	18.7		
8/21/79	5	19	19.7	17.9		
9/17/79	1	6	19.7	17.9		
9/17/79	2	13	17.2	17.7		
10/9/79	2	3	17.3	18.3	1.09	1.34

<u>BRANDS NOT POSTED</u>						
<u>Date</u>	<u>Cigarette No.</u>	<u>Run</u>	<u>Port</u>	<u>TPM(Dry)</u>	<u>Nicotine</u>	
9/28/79	97	1	17	12.1	.62	
9/28/79	163	1	18	10.3	.43	
9/28/79	172	1	19	17.8	1.32	
9/28/79	106	1	20	2.1	.18	
10/2/79	115	4	16	17.4	1.28	
10/2/79	116	4	18	16.3	1.19	
10/2/79	117	4	19	12.4	.97	
10/2/79	118	4	20	10.0	.69	

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Appendix III
Federal Trade Commission
"Tar" and Nicotine Determinations
Data Dated December 1979
Impossible Figures

<u>Date</u>	<u>Cigarette No.</u>	<u>Run</u>	<u>Port</u>	<u>Reason</u>
10/10/79	21	1	2	Negative Tar = -.08
10/10/79	21	5	12	Negative Tar = -.06

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Appendix IV

Federal Trade Commission

Data Dated December 1979

TPM (Dry) Determinations

By Brands

<u>Sample Number</u>	<u>Brands</u>	<u>TPM (Dry) in mgms</u>	
		<u>8/7/79</u>	<u>Overall Average Excluding 8/7/79</u>
479-1	Alpine kf sp m 85mm	14.2	14.6
2	American Lights f sp 120mm	8.8	7.8
3	American Lights f sp m 120mm	8.7	9.4
4	Artic Lights kf sp m 85mm	8.2	8.4
5	Artic Lights f sp m 100mm	10.8	9.4
8	Benson & Hedges reg f hp 70mm	1.3	.8
10	Benson & Hedges 100's f hp 100mm	17.9	16.6
11	Benson & Hedges 100's f hpm 100mm	16.7	17.5
12	Benson & Hedges 100's f sp 100mm	17.9	17.3
15	Benson & Hedges Lights f sp m 100mm	11.6	10.5
18	Camel kf sp 85mm	20.0	18.8
21	Carlton kf hp 85mm	.4	.2
22	Carlton kf sp 85mm	1.0	.9
28	Chesterfield kf sp 85mm	15.3	15.2
29	Chesterfield f sp 101mm	16.2	16.5
30	Decade kf sp 85mm	5.3	4.3
32	Doral kf sp 85mm	12.8	13.0
38	English Ovals knf hp 85mm	32.5	29.7
40	Eve f sp m 100mm	15.3	15.4
42	Eve 120's f hp m 120mm	13.9	13.2
44	Galaxy kf sp 85mm	17.8	16.9
45	Half & Half kf sp 85mm	23.6	24.4
47	Home Run reg nf sp 70mm	23.5	24.0
51	Kent III kf sp 85mm	3.7	2.9
56	Kent Golden Lights f sp 100mm	9.8	9.3
60	Kool kf sp m 85mm	16.5	16.1
62	Kool Super Lights kf sp m 85mm	8.6	9.3
64	Kool Super Lights f sp m 100mm	8.7	9.1
68	L & M f sp 100mm	17.2	15.9
71	Lark kf sp 85mm	17.3	17.4
72	Lark Lights kf sp 85mm	8.0	7.6
73	Lark f sp 100mm	19.6	19.1
77	Lucky Strike reg nf sp 70mm	24.3	23.8
78	Lucky Ten kf sp 85mm	9.0	8.7*
79	Lucky 100's f sp 100mm	5.2	3.6

* Corrected for calculation error.

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Appendix IV - continued

		TPM (Dry) in mgms	
Sample Number	Brand	8/7/79	Overall Average Excluding 8/7/79
479-80	Marlboro kf hp 80mm	17.0	17.1
81	Marlboro kf hp m 80mm	16.1	14.5
83	Marlboro Lights kf sp 85mm	11.8	11.7
85	Marlboro f hp 100mm	17.9	16.7
86	Marlboro f sp 100mm	15.3	16.7
89	Max f sp m 120mm	19.3	17.7
92	Merit 100's f sp 100mm	11.5	10.4
93	Merit 100's f sp m 100mm	9.4	10.7
94	Montclair kf sp m 85mm	17.4	17.0
97	Multifilter kf sp 85mm	11.7	11.3**
99	Newport kf hp m 80mm	15.5	15.9
100	Newport kf sp m 85mm	17.3	17.0
104	Now kf sp 85mm	2.4	1.8
109	Old Gold Filters kf sp 85mm	17.1	16.7
112	Pall Mall knf sp 85mm	25.4	24.3
115	Pall Mall f sp 100mm	17.9	17.8**
116	Pall Mall f sp m 100mm	15.3	15.9**
119	Parliament kf sp 85mm	9.4	9.4
120	Parliament Lights 100's f sp 100mm	11.6	11.6
121	Philip Morris reg nf sp 70mm	21.5	21.5
125	Picayune reg nf sp 70mm	23.6	22.6
126	Piedmont reg nf sp 70mm	23.8	22.9
127	Players reg nf hp 70mm	26.9	25.5
128	Raleigh knf sp 85mm	24.0	24.0
133	Real kf sp 85mm	9.5	10.1
136	St. Moritz f sp m 100mm	17.0	15.0
137	Salem kf hp m 80mm	17.6	16.5
141	Salem Long Lights f sp m 100mm	10.9	10.7
142	Saratoga f hp 120mm	17.2	16.7
149	Tareyton kf sp 85mm	14.4	14.0
150	Tareyton Lights kf sp 85mm	8.3	7.9
154	Tempo kf sp 85mm	7.7	7.5
155	Triumph kf sp 85mm	2.9	3.3
156	Triumph kf sp m 85mm	2.3	2.0
157	True kf sp 85mm	5.3	4.6
158	True kf sp m 85mm	4.5	4.6
162	Vantage kf sp 85mm	10.3	10.8
165	Viceroy kf sp 85mm	14.0	13.5
167	Viceroy f sp 100mm	16.0	15.6
176	Winston f sp m 100mm	21.2	18.9

**Corrected for posting error.

Appendix V
Federal Trade Commission
Data Dated December 1979
TPM (Dry) Determinations
By Brands

Sample Number	Brands	TPM (Dry) in mgms	
		10/10/79	Overall Average Excluding 10/10/79
479-1	Alpine kf sp m 85mm	14.2	14.6
4	Artic Lights kf sp m 85mm	7.9	8.4
5	Artic Lights f sp m 100mm	9.1	9.4
6	Belair kf sp m 85mm	8.7	9.6
7	Belair f sp m 100mm	10.3	8.7
11	Benson & Hedges 100's f hp m 100mm	17.0	17.4
12	Benson & Hedges f sp 100mm	17.5	17.4
14	Benson & Hedges Lights f sp 100mm	9.3	10.8
15	Benson & Hedges Lights f sp m 100mm	8.9	10.7
16	Bull Durham kf sp 85mm	27.6	28.3
17	Camel reg nf sp 70mm	25.5	25.5
18	Camel kf sp 85mm	18.4	18.9
21	Carlton kf hp 85mm	.0*	.3
23	Carlton kf sp m 85mm	.4	.6
25	Carlton 100's f sp m 100mm	4.6	4.8
27	Chesterfield k nf sp 85mm	27.6	27.5**
29	Chesterfield f sp 101mm	16.7	16.4
35	Doral II kf sp m 85mm	4.9	5.1
36	DuMaurier kf hp 85mm	14.2	15.5
60	Kool kf sp m 85mm	15.8	16.2
81	Marlboro kf hp m 80mm	12.9	14.7
83	Marlboro Lights kf sp 85mm	10.9	11.7
85	Marlboro f hp 100mm	16.5	16.8
86	Marlboro f sp 100mm	16.1*	16.7
87	Marlboro Lights f sp 100mm	11.9	11.7
91	Merit kf sp m 85mm	8.9	8.4
92	Merit 100's f sp 100mm	10.1*	10.5
97	Multifilter kf sp 85mm	10.2	11.4***
99	Newport kf hp m 80mm	15.9	15.9
101	Newport Lights kf sp m 85mm	9.3*	9.5
104	Now kf sp 85mm	1.7	1.9
105	Now kf hpm 85mm	1.5	1.8
106	Now kf sp m 85mm	1.9	1.8***

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Appendix V - continued

Sample Number	Brand	TPM (Dry) in mgms	
		10/10/79	Overall Average Excluding 10/10/79
479-107	Oasis kf sp m 85mm	16.9	15.4
108	Old Gold Straights knf sp 85mm	27.9	25.4
109	Old Gold Filters kf sp 85mm	16.3	16.7
111	Old Gold 100's f sp 100mm	18.3*	19.0
116	Pall Mall f sp m 100mm	15.7	15.8***
118	Parliament Lights kf hp 80mm	10.4	10.3***
126	Piedmont reg nf sp 70mm	23.4*	22.9
129	Raleigh kf sp 85mm	16.1*	16.1
138	Salem kf sp m 85mm	15.7	15.9
139	Salem Lights kf sp m 85mm	11.0*	11.0
140	Salem f sp m 100mm	18.8	19.5
143	Saratoga f hp m 120mm	15.0*	15.2
150	Tareyton Lights kf sp 85mm	7.5*	7.9
154	Tempo kf sp 85mm	7.5	7.5
155	Triumph kf sp 85mm	3.1	3.3
160	True 100's f sp m 100mm	13.5	13.7
161	Twist f sp L/M 100mm	15.9*	16.5
163	Vantage kf sp m 85mm	10.5	10.6***
169	Virginia Slims f sp 100mm	15.9	15.6
170	Virginia Slims f sp m 100mm	14.2	15.0
172	Winston kf sp 85mm	19.4*	19.7***
173	Winston Lights kf sp 85mm	14.1	13.9
175	Winston Lights 100's f sp 100mm	13.6*	13.3
176	Winston f sp m 100mm	18.3*	19.1

*Average used since more than one run made on specified day.

**Corrected for calculation error.

***Corrected for posting error.

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